EVALUATION OF PROPOSED TS CHANGES

TABLE OF CONTENTS

EVALUATION OF PROPOSED TS CHANGES

1.0 BACKGROUND INFORMATION

These proposed amendments to the St. Lucie Plant Unit 1 and 2 Technical Specifications are being submitted for NRC approval to: (1) increase the allowable spent fuel wet storage capacity at both units and include the description of Boral™ as the neutron absorbing material used in the new cask pit storage racks, and (2) revise the spent fuel pool (SFP) thermal-hydraulic analyses for core offload times of 120 hours after reactor shutdown and for a partial core offload as the normal offload condition.

All spent fuel at St. Lucie Units 1 and 2 is stored underwater in the respective unit's SFP. The Unit 1 pool is currently licensed to store a total of 1706 fuel assemblies in high-density racks using Boraflex™ neutron absorbing panels. Unit 2 is licensed to store 1360 fuel assemblies in storage racks that do not use Boraflex, but rely primarily on flux-trap water gaps to achieve subcriticality. Based on these capacities and current spent fuel loading, Unit 1 will be unable to offload a full reactor core by the year 2005. Similarly, Unit 2 will no longer have full core off-load capability by 2007.

To extend full core off-load capability beyond the above dates, Florida Power and Light (FPL) intends to install a freestanding spent fuel storage rack module in the cask pit area of each unit's fuel handling building (FHB). It is expected that each cask pit rack would be installed and remain in place until cask loading operations necessitate their removal. The cask pit is located in the northeast corner of the FHB adjacent to the SFP. The pit is normally flooded with borated water from the SFP, such that the pit and SFP are hydraulically connected. Because the cask pit floor is approximately four feet below the SFP floor, a platform will be installed beneath each unit's new storage rack to maintain all of the wet storage racks at a uniform elevation.

The additional storage capacity provided by the cask pit racks will be used to store spent fuel to allow refueling outage fuel offloads and non-outage fuel shuffles. In addition, the Unit 1 cask pit rack will be used to temporarily stage new fuel pre-outage, prior to loading into the reactor core. Because the cask pits will eventually be needed for loading fuel into transfer casks, the cask pit racks will be removed, cleaned, and stored in an alternate location prior to any spent fuel cask loading operations.

The new cask pit racks will use Boral as the neutron absorbing poison. The Unit 1 rack is designed to augment Region 1 storage by 143 assemblies of either fresh fuel or spent fuel, regardless of its burnup history, bringing the total Unit 1 storage capacity up to 1849 assemblies. The Unit 2 rack is a Region 2 type design with closer assembly-to-assembly spacing than the Region 1 rack, capable of storing 225 fuel assemblies with burnup histories that satisfy required burnup/enrichment combinations. The total Unit 2 storage capacity with the new rack will be 1585 assemblies. The additional storage capacity provided by the cask pit racks is expected to extend full core off-load capability several years, until 2008 on Unit 1 and until 2012 on Unit 2.

Although dry storage of spent fuel may eventually be needed at the St. Lucie site even with the approval of the proposed license amendments, it is prudent to maximize the existing wet storage facilities prior to initiating the licensing and construction of an on-site dry storage facility. Deferring the necessity for dry storage at St. Lucie will allow more time for development and improvement of multi-purpose canisters (MPCs). Such improvements may benefit radiation workers by reducing the total occupational exposure associated with handling and storing spent nuclear fuel.

Existing Plant Configuration

The cask pit area on each unit is currently vacant and flooded with water from the SFP. The cask pits are now being used for temporary underwater storage of miscellaneous small equipment. For Unit 2 only, the transfer slot between the cask pit and the SFP is open with the bulkhead gate removed. No transfer slot exists on Unit 1, and the cask pit area is continuously open to the SFP.

The SFP cooling system configuration and design basis are described in each unit's UFSAR Section 9.1.3. For Unit 1, the design basis requires maintaining the SFP bulk temperature less than 150°F during a partial core offload with one operating cooling pump. For Unit 2, the 150°F temperature limit applies to both partial and full core offloads, and a cycle-specific calculation is required to be performed for full core offloads to demonstrate that the SFP bulk temperature will not exceed 150°F with one cooling pump and one heat exchanger in operation.

Proposed Plant Configuration

These amendments propose to install a new freestanding storage rack in each unit's cask pit. The equipment now stored in the cask pit area will be removed and the cask pit floor will be cleaned prior to installation of the new storage rack. For Unit 2, the fuel storage procedures will prohibit installing the bulkhead gate in the transfer slot whenever spent fuel is stored in the cask pit rack, to allow the free exchange of cooling water between the cask pit and the SFP.

These amendments also propose to revise the SFP cooling system design bases for both units to make the bases consistent with Section 9.1.3 of the NRC Standard Review Plan (NUREG-0800). The amendments propose to require that the SFP bulk temperature be maintained less than or equal to 150°F under each of two conditions: a normal partial core offload with one cooling pump operating, and a full core offload with both cooling pumps operating (both cooling pumps and both heat exchangers at Unit 2). Based on a review of recent and projected operating cycles, a partial core offload is the normal offload condition for both St. Lucie units. With this change, SFP cooling system operation during a full core offload with only one cooling pump and heat exchanger operating would be a cooling configuration outside the cooling system's design basis, and the 150°F bulk temperature limit would not apply. Instead, the success criterion for the full core offload would be to avoid SFP boiling with this minimum cooling configuration.

Precedent Licensing Actions

Similar license amendments at other plants have increased spent fuel storage by adding storage racks in confined SFP areas. In July 1998, Waterford 3 received a license amendment to increase SFP storage capacity by adding storage racks in the cask storage pit and refueling canal. Similarly, Kewaunee received approval in January 2001 to increase allowable spent fuel storage capacity by adding a new storage rack in a fuel transfer canal pool. Both plants installed new racks manufactured by the same vendor as the new St. Lucie racks.

2.0 DESCRIPTION OF PROPOSED CHANGE

FPL proposes to modify Technical Specification Section 5.6, Design Features - Fuel Storage, for both St. Lucie units. Section 5.6 will be revised to include the new cask pit rack design and reflect the increased spent fuel storage capacity when the cask pit rack and existing SFP rack capacities are combined. A markup of the proposed changes is shown in Attachments 3 and 4.

The following Unit 1 Technical Specification changes are proposed (added words in **bold**):

a. Section 5.6.1.a.2 is revised to read: "A nominal 10.12 inches center to center distance between fuel assemblies in Region 1 of the **spent fuel pool** storage racks, **a nominal 10.30 inches center to center distance between fuel assemblies in the Region 1 cask pit storage rack**, and a nominal 8.86 inches center to center distance between fuel assemblies in Region 2 of the **spent fuel pool** storage racks."

b. Section 5.6.1.a.4 is revised to read: "Neutron absorber (boraflex) installed between spent fuel assemblies in the **spent fuel pool** storage racks in Region 1 and Region 2. **Neutron absorber (boral) installed between spent fuel assemblies in the Region 1 cask pit storage rack.**"

c. Section 5.6.3 is revised to read: "The spent fuel pool **storage racks are** ~~is~~ designed and shall be maintained with a storage capacity limited to no more than 1706 fuel assemblies, **and the cask pit storage rack is designed and shall be maintained with a storage capacity limited to no more than 143 fuel assemblies. The total Unit 1 spent fuel pool and cask pit storage capacity is limited to no more than 1849 fuel assemblies.**"

The following Unit 2 Technical Specification changes are proposed:

a. Section 5.6.1.a is revised to read: "The ~~spent fuel pool and~~ spent fuel storage racks **are designed and** shall be maintained with:"

b. Section 5.6.1.a.3 is revised to read: "A nominal 8.96 inch center-to-center distance between fuel assemblies placed in the **spent fuel pool** storage racks **and a nominal 8.80 inch center-to-center distance between fuel assemblies placed in the cask pit storage rack.**"

c. Section 5.6.1.c.1 is revised to read: "Fuel placed in **the** Region II **spent fuel pool storage racks** shall meet the burnup and decay time requirements specified in Figure 5.6-1a or 5.6-1b. **Fuel placed in the Region II cask pit storage rack shall meet the burnup requirements specified in Figure 5.6-1f.**"

d. Section 5.6.3 is revised to read: "The spent fuel ~~storage~~ pool **storage racks are** ~~is~~ designed and shall be maintained with a storage capacity limited to no more than 1360 fuel assemblies, **and the cask pit storage rack is designed and shall be maintained with a storage capacity limited to no more than 225 fuel assemblies. The total Unit 2 spent fuel pool and cask pit storage capacity is limited to no more than 1585 fuel assemblies.**"

e. Add new Figure 5.6-1f, "Required Fuel Assembly Burnup vs Initial Enrichment, Region II Cask Pit Storage Rack."

3.0 BASIS/JUSTIFICATION FOR PROPOSED CHANGES

3.1 OVERVIEW

The basis for requesting the proposed changes to Section 5.6 of the St. Lucie Technical Specifications (TS) regarding the new cask pit racks is to extend the full core off-load capability of each St. Lucie unit by at least three years, by increasing the available spent fuel wet storage capacity. Extending full core off-load capability will provide FPL additional time to evaluate optional spent fuel storage strategies, including SFP re-racking, construction of an on-site dry storage facility, and off-site disposal.

Holtec, the cask pit rack vendor, prepared a License Amendment Report for the proposed license amendments. The License Amendment Report is provided as Enclosure 2 to the proposed license amendments, and will hereby be referred to as "Enclosure 2." Enclosure 2 provides detailed information on the design and analysis of the new racks. The physical layout of the Unit 1 and Unit 2 cask pit racks and the surrounding wall gaps are shown in Figures 1.1.1 and 1.1.2, respectively, of Enclosure 2. Section 2 of the enclosure describes the physical design of the racks and individual rack cells, and Section 5 describes the thermal-hydraulic relationship of the cask pit area to the SFP on each unit. Section 8 describes the structural arrangement of the cask pit and SFP in each unit's FHB.

The following sections provide technical justification for installing a cask pit rack on both units. Extensive reference is made to Enclosure 2. Areas evaluated include:

- criticality
- thermal-hydraulics
- rack and pool structural integrity
- handling of heavy loads
- handling of fuel assemblies
- radiological considerations
- other issues

3.2 CRITICALITY CONSIDERATIONS

This section summarizes the cask pit rack criticality analyses performed by Holtec, the rack vendor. A more detailed discussion of the analysis methodology, assumptions, and results is included in Section 4.0 of Enclosure 2.

The criticality analyses demonstrate that the Unit 1 and Unit 2 cask pit rack designs maintain subcriticality with margin during both normal and abnormal conditions.

For Unit 1, the analysis required k_{eff} to be equal to or less than 0.95 when the fully loaded Region 1 rack is flooded with unborated water. For Unit 2, the analysis required a k_{eff} below 1.0 when the fully loaded Region 2 rack is flooded with unborated water, and a k_{eff} equal to or less than 0.95 when partial credit is taken for soluble boron. For both units, the maximum calculated k_{eff} includes consideration of abnormal fuel drop and loading scenarios, and includes margin for biases and uncertainties in the reactivity calculations, including manufacturing tolerances. As permitted in the USNRC guidelines, independent uncertainties are statistically combined, such that the final k_{eff} will satisfy the required subcriticality limit with a 95% probability at a 95% confidence level.

The criticality analyses for the two units are discussed separately below, because the cask pit racks are of different designs for different fuel storage regions with different analysis assumptions and acceptance criteria.

Unit 1 Cask Pit Rack

The Unit 1 cask pit rack is designed for Region 1 fuel storage to assure that the maximum reactivity, including biases and uncertainties, is equal to or less than 0.95 with the racks fully loaded either with fresh fuel assemblies of 4.50 $\pm$ 0.05 wt % maximum U^{235} enrichment or with spent fuel assemblies regardless of their burnup history. The analysis assumes that the rack is flooded with unborated water at an operating temperature corresponding to the highest reactivity (50°F [10°C]). The maximum calculated reactivity includes a margin for uncertainties, including manufacturing tolerances. All independent uncertainties are statistically combined, such that the final k_{eff} will be equal to or less than 0.95 with a 95% probability at a 95% confidence level.

For reactivity control, the Unit 1 rack cells employ Boral neutron absorber panels mounted on the outside faces of stainless steel boxes of 8.58 inch inside diameter (except cells on the rack periphery which contain no Boral panel on the outer face) in conjunction with water gaps between adjacent cells. The Boral panels are nominally 7.25 inches wide and 140 inches long, and are held in place and protected against damage by stainless steel sheathing. The storage cells are assembled into an 11x13 cell array with a nominal lattice center-to-center spacing (pitch) of 10.30 inches, using welded connector bars. This cell spacing forms a nominal flux-trap water gap of approximately 1.3 inches between adjacent cells. For neutron leakage, the analysis conservatively assumes an infinite radial array of storage cells, and a 30 cm (12 inch) water reflector is conservatively assumed in the axial direction.

The criticality analysis uses the three-dimensional MCNP4a Monte Carlo code developed by the Los Alamos National Laboratory as the primary methodology for the reactivity calculations. The CASMO4 code was used to determine the reactivity effects of manufacturing tolerances. The two fresh fuel assembly types expected to be stored in the Region 1 cask pit rack were evaluated to determine the most reactive fuel type (Framatome 14x14). Fresh fuel is inherently more reactive than spent fuel, and provides the limiting storage case for the Unit 1 cask pit rack criticality analysis.

In addition to calculating the reactivity with fresh fuel stored in the rack, two dropped fuel assembly events were also evaluated. A deep drop of a fresh fuel assembly into an open cell causes local deformation of the base plate, and was found to cause a very small increase in reactivity (+0.0001 Δk), compared to a drop on top of the rack which caused a negligible reactivity increase.

No fuel misloading scenarios were evaluated for the Unit 1 cask pit rack criticality evaluation. Misloading of a fuel assembly in the rack cells cannot occur, because the rack is a Region 1 design capable of accepting either fresh fuel enriched up to the maximum 4.5% or spent fuel with any burnup history. A misloading accident in which a fuel assembly is inadvertently placed outside the rack between the rack and the cask pit wall is not assumed due to an insufficient rack-to-wall gap around the rack periphery. Although it may be physically possible to install the rack such that the gap in the east-west direction is large enough for a fuel assembly to fit between the rack and the pit wall, the rack installation procedure will center the rack in the pit such that the gap on all sides is less than the width of a fuel assembly.

Analysis Results

The Unit 1 criticality analysis described in Section 4.1 of Enclosure 2 demonstrates that the maximum cask pit rack reactivity of 0.9061, which includes biases and uncertainties, provides significant margin from the analysis acceptance criterion of less than or equal to 0.95 when the fully loaded Region 1 rack is flooded with unborated water.

Unit 2 Cask Pit Rack

The Unit 2 cask pit rack is designed for Region 2 storage of spent fuel assemblies (no fresh fuel stored) to assure that the maximum reactivity, including biases and uncertainties, remains subcritical (k_{eff} below 1.0) when flooded with unborated water, and equal to or less than 0.95 when credit is taken for soluble boron in the cooling water. These reactivity limits are consistent with Unit 2 Technical Specification 5.6.1.a and also with 10 CFR 50.68(b)(4) when credit is taken for soluble boron. The criticality analysis assumes that the rack is fully loaded with spent fuel assemblies (at a maximum initial enrichment of 4.50 ± 0.05 wt % U^{235}) having a minimum burnup of 36,000 MWD/MTU. In addition to evaluating reactivity for normal loading in the racks, the reactivity resulting from a misloading accident, where a fresh fuel assembly was placed outside the rack or into a cell intended to contain a spent fuel assembly, was also evaluated.

Figure 4.2.1 in Enclosure 2 provides the minimum burnup level to satisfy the cask pit rack criticality analysis results for any fuel enrichment value between 2 and 4.5 weight percent. The acceptable burnup domain identified in Figure 4.2.1 is incorporated into new Unit 2 TS Figure 5.6-1f.

For conservatism, the analysis was performed assuming unborated water as the moderator at an operating temperature corresponding to the highest reactivity (50°F [10°C]). The maximum calculated reactivity also includes a margin for biases and uncertainties, including manufacturing tolerances. Independent uncertainties are statistically combined, such that the final calculated k_{eff} value will have a 95% probability at a 95% confidence level.

Similar to the Unit 1 rack, the Unit 2 rack cells employ Boral neutron absorber panels mounted on the outside faces of stainless steel boxes of 8.58 inch inside diameter. The storage cells are joined at the corners in a checkerboard pattern into a 15x15 cell array with a nominal lattice center-to-center spacing (pitch) of 8.80 inches using connecting bars, such that each group of four joined box cells form an additional cell between the boxes, referred to as a "formed cell." With this pattern, adjacent cells in the Unit 2 rack are separated by only one Boral panel, as compared to two panels and a water gap separating adjacent cells in the Unit 1 cask pit rack. Similar to Unit 1, for neutron leakage, the analysis conservatively assumes an infinite radial array of storage cells, and a 30 cm (12 inch) water reflector is conservatively assumed in the axial direction.

The Unit 2 analysis also uses the three-dimensional MCNP4a Monte Carlo code developed by the Los Alamos National Laboratory as the primary methodology for the reactivity calculations. The CASMO4 code was used to determine the reactivity effects of manufacturing tolerances. Three spent fuel assembly types expected to be stored in the Unit 2 cask pit rack were evaluated, to determine the most reactive fuel type (Combustion Engineering 16x16).

In addition to calculating reactivity with spent fuel filling the rack, four abnormal fuel assembly events were also evaluated. A misloaded fresh fuel assembly placed into a rack cell intended to store a spent fuel assembly was found to be more reactive than either a dropped assembly resting on top of the rack, a spent fuel assembly dropped into a cell that deforms the rack baseplate, or an assembly mispositioned between the rack and the pit wall. The deep drop of a fresh fuel assembly into a cell was not evaluated because the coincident conditions of a fresh assembly and a deep drop would violate the double contingency principle; an NRC staff principle that precludes the assumption of two unlikely, independent, concurrent events to ensure protection against a criticality accident.

Analysis Results

The Unit 2 criticality analysis described in Section 4.2 of Enclosure 2 demonstrates that the maximum cask pit rack reactivity of 0.9154, which includes uncertainties, provides significant reactivity margin from the analysis acceptance criterion of less than 1.0 with unborated water. Further, the analysis demonstrates that for the worst-case fresh fuel assembly misloading condition with unborated water, the maximum reactivity is 0.9417, which is also below the 1.0 limit. Therefore, the cask pit rack satisfies both Unit 2 spent fuel storage reactivity criteria by maintaining reactivity below 1.0 for any evaluated fuel loading condition when flooded with unborated water, and also maintaining reactivity below 0.95 without the need to credit soluble boron. Accordingly, the proposed amendment includes no change to the Unit 2 TS 5.6.1.a.2 boron concentration value, and no revision to the existing boron dilution analysis was necessary.

3.3 THERMAL-HYDRAULIC CONSIDERATIONS

This section summarizes the thermal-hydraulic analyses performed by Holtec, the rack vendor, to determine the peak SFP bulk temperatures and maximum local water and fuel assembly temperatures with a new cask pit rack installed on each unit. A more detailed discussion of the thermal-hydraulic analysis methodology, assumptions, and results is included in Section 5 of Enclosure 2.

Forced cooling to each unit's SFP is supplied by a single cooling loop. The Unit 1 SFP cooling loop draws water from the pool with two parallel cooling pumps that discharge to a common header supplying a single shell-and-tube heat exchanger

(HX). The Unit 2 SFP cooling loop contains two parallel cooling pumps that discharge to a common header supplying two parallel shell-and-tube heat exchangers. The shell side of the heat exchangers on both units is cooled by component cooling water. On Unit 2, both heat exchangers are normally in service when both cooling pumps are operating, while both Unit 1 pumps supply the single heat exchanger.

These amendments propose to modify the SFP cooling system (SFPCS) design basis. The proposed design basis SFP cooling configurations for both St. Lucie units are one cooling pump and heat exchanger supplying cooling during a normal partial core offload, and both cooling pumps with all available heat exchangers (one on Unit 1 and two on Unit 2) providing maximum cooling during a full core offload.

Unit 2 UFSAR Section 9.1.3 currently requires FPL to perform an outage-specific calculation during a full core offload to demonstrate that the SFP bulk temperature will not exceed 150°F with one cooling pump and one heat exchanger in operation. This license condition was imposed in 1999 because a full core offload was considered the "normal" Unit 2 offload condition at that time. Under these amendments, a partial core offload is the normal offload condition for both units, and the single pump cooling configuration during a full core offload (resulting from the active failure of one pump) is considered a configuration outside the SFP cooling system design basis. The design basis change would allow the SFP bulk temperature to exceed 150°F during a full core offload with minimum cooling, provided no SFP bulk boiling occurred. This design basis change meets the intent of NRC Standard Review Plan Section 9.1.3, "Spent Fuel Pool Cooling and Cleanup System," because a partial core offload is now the normal offload condition for both St. Lucie units.

SFP Cooling System (SFPCS) Scenarios Evaluated

Three SFP cooling scenarios were evaluated to determine the maximum SFP bulk temperature. The first two scenarios will occur under the proposed design basis cooling conditions and the third scenario is considered outside the proposed SFPCS design basis. The three scenarios are:

Scenario 1 - a normal partial core offload with minimum cooling (one pump and one HX)
Scenario 2 - a full core offload with maximum cooling (two pumps and available HX(s))
Scenario 3 - a full core offload with minimum cooling (one pump and one HX)

The SFP decay heat load is greater during core offload conditions than during non-offload conditions. Therefore, the peak SFP temperature during routine operation was not evaluated, because it is bounded by the peak SFP temperatures occurring during a core offload.

For Scenarios 1 and 2, the SFPCS is required to maintain the SFP bulk temperature less than or equal to 150°F. Scenario 1 for each unit assumes one cooling pump supplying one heat exchanger. For Scenario 2 with two pumps operating, the combined pump flow supplies the single Unit 1 heat exchanger, while the combined pump flow is shared between both heat exchangers on Unit 2.

Scenario 3 represents a core offload cooling condition outside the cooling system design basis, to determine the peak SFP temperature that could occur with the decay heat load imposed from a full core offload coincident with minimum cooling. In addition to Scenario 3, a fourth scenario beyond the SFPCS design basis was also evaluated for the sole purpose of determining a maximum "accident" decay heat load that might be imposed on the SFP and the resultant maximum bulk temperature with one cooling pump operating. This worst-case SFP cooling condition is a full core offload occurring 90 days after a refueling outage. The condition assumes a batch of 72 assemblies are offloaded from the reactor during refueling. After restart and 90 days at power, the full core of 217 assemblies is offloaded to the SFP starting at 72 hours after reactor shutdown, completely filling all available storage locations. As with Scenario 3, one SFPCS pump is operating throughout the transient evaluation. The peak temperature value from these two scenarios will determine if pool boiling occurs for a minimum cooling condition beyond the SFPCS design basis.

SFPCS Performance Data

The calculated heat transfer rate from the SFPCS to component cooling water varies with time as a function of several independent variables, including flowrates, temperatures, and heat exchanger fouling and tube plugging. The SFPCS pump and heat exchanger performance data used in the SFP bulk temperature calculations for both units are discussed in Section 5.4 of Enclosure 2. Conservative values for pump flow and heat exchanger performance were selected to provide bounding calculations for the peak SFP bulk temperature. The thermal performance of the heat exchangers was determined with all heat transfer surfaces assumed to be fouled to their design basis maximum levels, and also included an allowance for 5% tube plugging. Component cooling water supplied to the heat exchangers was assumed to be at its maximum design temperature of 100°F. The assumed cooling water flowrate of 2850 gpm to each heat exchanger was based on existing administrative control by procedure during refueling. On the SFP water side, the SFPCS pump and heat exchanger flowrates given in Table 5.4.1 of Enclosure 2 are based on conservative calculations that include an allowance for 10% pump degradation.

SFP Decay Heat Load

The SFP bulk temperature analysis requires quantifying the total decay heat load as a function of time after reactor shutdown and core offload time. The total decay heat load imposed on the SFP cooling system was evaluated as the sum of two decay heat sources: decay heat from previous offloads already stored in the pool (assumed to be a constant), and decay heat from fuel assemblies recently offloaded from the reactor (variable with time after reactor shutdown).

The steady-state decay heat load from previously offloaded fuel was calculated using the LONGOR computer program, based on a power history and fuel offload schedule that projects more spent fuel assemblies (including the fuel assemblies from a core offload) than the total number of storage cells in the SFP and cask pit rack. This results in a conservatively high estimate of the decay heat load. Pump heat from the SFP cooling system was also included in the total steady-state heat load.

For both units, the transient decay heat load was calculated for three core offload conditions:

- a normal partial core offload of 105 assemblies
- a full core offload of 217 assemblies
- a normal partial core offload of 72 assemblies followed 90 days later by a full core offload of 217 assemblies

The core offload time for the first two conditions is 120 hours after reactor shutdown. The offload rate is assumed to be instantaneous to maximize decay heat, except for Unit 2 full core offload cooling Scenario 3 which assumes an offload rate of eight assemblies per hour. The decay heat contribution from each offload condition was determined using the LONGOR computer program, which incorporates the ORIGEN2 code for performing decay heat calculations. For each condition, the transient and steady-state decay heat loads were then combined to provide a total decay heat load on the SFP cooling system beginning at the assumed offload start time of 120 hours after reactor shutdown.

The full core offload time for the third condition is 72 hours after reactor shutdown, to conservatively maximize the transient decay heat load resulting from combining the decay heat loads from the normal partial core offload and the "accident" full core offload occurring 90 days later.

A partial core offload is the normal offload condition for both St. Lucie units based on a review of recent and projected refueling cycles for each unit. The 120 hour core offload time after reactor shutdown was chosen based on recent St. Lucie refueling history, and is less than the minimum offload times permitted under existing St. Lucie refueling procedures. However, if future refueling times below 120 hours are considered, an outage-specific engineering evaluation will be completed which demonstrates that the SFP coolant temperature will remain less than or equal to 150°F during a partial core offload with one SFP cooling pump or during a full core offload with two SFP cooling pumps operating (including both heat exchangers for Unit 2).

Maximum SFP Bulk Temperatures

The SFP bulk temperature versus time was calculated for each of the four SFP cooling scenarios (Scenarios 1 through 3, plus the worst-case "accident full core offload" scenario) using the BULKTEM computer program, based on the time-varying total decay heat load on the pool and the SFPCS pump and heat exchanger alignment. The calculations also considered passive heat losses to the air above the pool and included several conservative assumptions regarding heat exchanger fouling and tube plugging, SFP thermal capacity, reactor power, and bounding core offload parameters. These assumptions are discussed in Section 5.4 of Enclosure 2.

The results of the SFP bulk temperature calculations for both St. Lucie units are shown in Table 5.8.1 of Enclosure 2. The results demonstrate that the peak SFP bulk temperatures for Scenario 1 (partial core offload with one pump) and Scenario 2 (full core offload with two pumps, plus two heat exchangers for Unit 2) are below the design basis limit of 150°F. The highest bulk temperature for Scenarios 1 and 2 occurs under Unit 2 Scenario 2, peaking at approximately 143°F at 133 hours after reactor shutdown.

For Scenario 3 (full core offload with minimum cooling), the SFP bulk temperature calculations for both units demonstrate that the peak SFP temperature is well below the SFP boiling temperature. The highest Scenario 3 bulk temperature occurs on Unit 2, reaching a peak of approximately 166°F at 159 hours after reactor shutdown. For the worst-case "accident full-core offload" scenario, the evaluation concluded that the peak SFP bulk temperature was 172°F on Unit 1 and 179°F on Unit 2. These results demonstrate that no pool boiling occurs with minimum SFPCS cooling caused by a cooling pump single failure under either full core offload scenario.

Therefore, with the new cask pit racks installed, the SFP bulk temperature is less than 150°F for both proposed design basis core offload cooling scenarios, and no SFP boiling occurs for any full core offload scenario with minimum SFPCS cooling.

Minimum Time-to-Boil and Maximum Boil-off Rate

Two SFP loss of forced cooling scenarios were evaluated for each unit. The first scenario assumed a partial core offload (similar to cooling Scenario 1), and the second scenario assumed a full core offload (similar to cooling Scenario 3). Both scenarios assumed an instantaneous core offload rate to maximize the decay heat load and minimize the time-to-boil for a loss of forced cooling.

To further minimize the time-to-boil, the evaluation assumed that forced cooling was lost at the moment that the peak SFP bulk temperature for each scenario was reached. The SFP time-to-boil and corresponding maximum boil-off rate were then determined. In addition, the minimum required makeup water flow to prevent the pool water level from dropping below nine feet above the top of the stored fuel assemblies was determined, assuming that makeup was initiated at the onset of pool boiling.

As shown in Table 5.8.2 of Enclosure 2, the calculated minimum time-to-boil occurred following an instantaneous full core offload on Unit 2 at 3.1 hours after a loss of forced cooling at the peak SFP bulk temperature. The corresponding maximum boil-off rate for this condition was approximately 85 gpm, and the minimum makeup water flow required was 54 gpm. The difference in these rates reflects the dynamic nature of the calculation, whereby the constant makeup flow rate turns the time-varying loss from boil-off at a water level nine feet above the stored assemblies. For both units, two permanent SFP makeup sources (the refueling water tank via the fuel pool purification pump and the primary water system) are each capable of separately providing SFP makeup at a flowrate greater than the maximum boil-off rate. A seismic Category 1 backup salt water supply is also available from the intake cooling water intertie.

For Unit 1, loss of SFP cooling following a full core offload results in a calculated minimum time-to-boil of 3.3 hours. This time is less than the current 5.04 hour time-to-boil discussed in the Unit 1 UFSAR. Reducing the Unit 1 minimum time-to-boil below the current UFSAR value is justified based on the following description of operator response to a loss of SFP cooling.

A loss of SFP cooling on each unit will be annunciated in the control room by alarms for fuel pool cooling pump low discharge header pressure and high SFP temperature. An existing St. Lucie procedure governs operator response to these conditions to restore cooling flow and to provide SFP makeup water as necessary to maintain SFP level. The low pump discharge pressure condition will be alarmed at approximately 18 psig decreasing on loss of cooling pump flow, and the SFP high temperature alarm will occur at less than 138°F on each unit. The worst case 3.1 hour time-to-boil scenario starts from a theoretical SFP temperature of almost 166°F, which is significantly above the SFP high temperature alarm setpoint. Therefore, operator awareness of elevated pool temperature would be established well before the 3.1 hour time-to-boil clock starts, and the loss of cooling would be immediately apparent by the low pump discharge pressure alarm. Based on the time-to-boil, plant personnel will have sufficient time to identify and respond to a total loss of forced SFP cooling prior to the onset of SFP bulk boiling and will have adequate time to provide makeup to the SFP, if needed.

Maximum Local Temperatures

The maximum local water and fuel clad temperatures that may occur in the cask pit rack were determined for both units. The discussion of maximum local temperatures found in Section 5.6 of Enclosure 2 is summarized below. The methodology for determining local temperatures differs between the two units because the hydraulic coupling between the cask pit and SFP varies for each unit. The flooded Unit 1 cask pit area is open to the SFP above a submerged partial-height wall on two sides of the pit, allowing a free exchange of cooling water between the pool and pit areas. The Unit 2 cask pit is isolated from the pool by a full height wall, except for an open fuel transfer slot in the west pit wall that extends approximately 25 feet underwater. All cooling water exchange between the cask pit and pool on Unit 2 must pass through this three-foot wide opening. A description of the cooling mechanism through this opening on Unit 2 is provided below.

The acceptance criteria applied to the local temperature evaluations for both units are the same. The bounding peak local water temperature in the cask pit rack cell containing the hottest spent fuel assembly must be less than the local saturation temperature of water at the rack depth, and the bounding peak fuel cladding temperature for the hottest fuel assembly should also be less than the local saturation temperature of water. If the cladding temperature exceeds the local saturation temperature, then departure from nucleate boiling (DNB) is not permitted to occur.

Unit 1 Cask Pit Rack Local Temperatures

The close hydraulic coupling between the cask pit and the SFP on Unit 1 allows the local temperature analysis to model the cask pit rack in a rectangular pool created by combining the SFP and cask pit, using the FLUENT fluid flow and heat transfer modeling program. Quantification of the coupled flow and temperature fields between the cask pit rack and the SFP was accomplished through use of a computational fluid dynamics (CFD) analysis using FLUENT. The loaded rack internal flow characteristics for the three-dimensional model were chosen based on hydraulic resistance parameters more conservative than the most limiting rack design and fuel assembly type, and volumetric decay heat generation rates for the hottest fuel assemblies were extracted from the pool bulk temperature analysis.

To determine the maximum local water temperature in the rack, a single bounding scenario was then evaluated using FLUENT that included the highest bulk SFP temperature and decay heat loads, the highest fuel assembly hydraulic resistance and the additional resistance of an assumed dropped fuel assembly laying across every cell in the rack. A separate calculation was performed to determine the maximum fuel clad superheat, which was then added to the maximum local water temperature to determine the peak fuel cladding temperature.

The results of the Unit 1 cask pit rack local temperature analysis demonstrate that the calculated worst-case peak local water temperature (190°F) is below the local saturation temperature at the water depth of the cask pit rack (240°F). The results also demonstrate that the peak fuel cladding temperature (242°F) for the hottest fuel assembly is slightly above the local saturation temperature and that the critical heat flux for departure from nucleate boiling (DNB) is not exceeded. Therefore, no bulk boiling will occur in the Unit 1 cask pit rack and the local water and fuel temperatures are acceptable.

Unit 2 Cask Pit Rack Local Temperatures

The Unit 2 cask pit rack is also modeled using a computational fluid dynamics (CDF) analysis using FLUENT to calculate the maximum local temperatures based on the spent fuel characteristics and cask pit geometry that are unique to Unit 2. Because the Unit 2 cask pit rack is a Region 2 design, the fuel assemblies in the rack are assumed to be spent fuel assemblies that have decayed at least 18 months. For the local temperature analysis, the rack is assumed to have 105 assemblies with 18 months of cooling time, 105 assemblies with 36 months of cooling time, and 15 assemblies with 54 months of cooling time. Unit 2 administrative controls will be established to prevent fuel assemblies discharged directly from core offloads from being stored in the cask pit rack, and will also require that the fuel assemblies stored in the rack satisfy the local temperature analysis assumptions regarding the number of assemblies permitted in the rack with minimum 18, 36, and 54 month cooling times. These controls will preclude loading the Unit 2 cask pit rack with fuel assemblies that would invalidate the local temperature analysis.

No forced cooling is supplied to the Unit 2 cask pit. When spent fuel is stored in the cask pit rack, cooling water flow between the cask pit and the SFP occurs by natural circulation through a 3-foot wide fuel transfer slot in the 5½-foot thick concrete wall separating the cask pit from the SFP. The slot extends from the pool surface to approximately 25 feet below the surface, such that the slot bottom elevation is near the top of the storage racks in both the pool and pit. The passive cooling mechanism involves relatively cool water from the SFP entering the cask pit through the bottom region of the slot, flowing down the rack periphery into the rack lower plenum, being warmed by spent fuel stored in the rack cells, rising by buoyancy to exit the top of the rack, and finally exiting the pit through the top portion of the slot This natural circulation flow pattern is shown graphically in Figure 5.8.9 of Enclosure 2.

The fuel transfer slot between the Unit 2 cask pit and SFP was designed with a channel for inserting a metal bulkhead (gate) to seal the slot, if it was necessary to drain the pit without affecting pool level. To maintain passive cooling flow whenever spent fuel is stored in the cask pit rack, the slot must remain open with the bulkhead removed. The procedure for loading fuel into the cask pit rack will require that the transfer slot be unobstructed with the bulkhead removed at all times when spent fuel assemblies are in the rack.

Because the Unit 2 cask pit is isolated from the SFP except for the transfer slot, only the cask pit and the slot were modeled by a computational fluid dynamics (CFD) analysis using FLUENT. For this model, the inlet water temperature from the SFP end of the slot was conservatively set equal to 180°F, which is greater than the highest calculated peak SFP bulk temperature. The flow characteristics through the loaded rack in the three-dimensional model were also conservatively chosen based on hydraulic resistance parameters more limiting than the most restrictive cell design and fuel assembly type, as well as the additional hydraulic resistance of an assumed dropped fuel assembly laying across every cell in the rack. The model then calculated the maximum local water temperature under these bounding conditions.

A separate calculation was performed to determine the maximum fuel clad superheat of the most recent (18-month decayed) fuel, which was then added to the maximum local water temperature to determine the peak fuel cladding temperature.

The results of the Unit 2 cask pit rack local temperature analysis demonstrate that the calculated worst-case peak local water temperature (189.1°F) and the peak fuel cladding temperature (192.35°F) are well below the local saturation temperature at the water depth of the cask pit rack (240°F). Therefore, no bulk boiling will occur in the Unit 2 cask pit rack and the local water and fuel temperatures are acceptable.

3.4 SEISMIC AND STRUCTURAL EVALUATION

This section summarizes the structural analyses performed for the racks and supporting structures. A more detailed discussion of the structural analysis methodology, assumptions, and results for the racks is included in Sections 6, 7, and 8 of Enclosure 2 (for the supporting structures).

The analyses performed to demonstrate structural adequacy include:

1) Rack structural evaluation during seismic events
2) Rack structural evaluation during fuel assembly drop events
3) FHB structural evaluation (including SFP and cask pit)

The plan view dimensions of the cask pit racks and the nominal gaps between the rack and surrounding walls are shown in Enclosure 2, Figures 1.1.1 and 1.1.2, for Units 1 and 2, respectively. The structural arrangement of the cask pit area relative to the surrounding walls of each unit's FHB is shown in Enclosure 2, Figures 8.1.1 and 8.2.1, for the respective units.

In summary, a complete reevaluation of the mechanical and civil structures has been performed to address the structural issues resulting from the installation of a storage rack in the cask pit of each unit. The analysis considered the loads from seismic, thermal, and mechanical forces to determine the margin of safety in the structural integrity of the new storage rack, the cask pit platform, the cask pit and liner, and the FHB. The loads, load combinations, and acceptance criteria for the storage rack, platform, and liner were based on ASME Section III, Subsection NF, and on NUREG-0800, "Standard Review Plan" (SRP), Section 3.8.4, Appendix D. Load combinations and structural assessment of the FHB concrete followed the requirements of the respective UFSAR and the American Concrete Institute; ACI 318-63 for Unit 1 and ACI 318-71 for Unit 2.

Cask Pit Rack Structural Evaluation During Seismic Events

The analyzed storage configuration consists of one freestanding and self-supporting rack storage module in the cask pit of each unit. The seismic analysis models a single rack, since the walls of the cask pit separate this area from the SFP, effectively isolating the rack. The seismic analysis was based on the simulation of the safe shutdown earthquake (SSE) and the operating basis earthquake (OBE) in accordance with SRP 3.7.1 requirements.

Separate models were developed for each of the two units. The cask pit racks were modeled as fully loaded with fuel assemblies. The average fuel assembly weight was conservatively chosen to account for a number of fuel assemblies that may also contain a control element assembly (CEA). Other analysis assumptions and details of the dynamic model for the rack structure are discussed in Section 6.5 of Enclosure 2.

The results indicate that the maximum seismic displacements do not result in any impacts with the cask pit walls. The resultant member and weld stresses in the racks are all below the allowable stresses, with a safety factor of 5.8. This minimum calculated safety factor is associated with the cell membrane material. The minimum safety factor for the pedestal support is 5.3. Therefore, the racks will remain functional during and after a SSE.

As shown in Section 6.8.1 of Enclosure 2, a maximum rack lateral displacement of 0.396 inches was found to occur in the Unit 2 cask pit rack under SSE conditions. This displacement bounds all other cases on both units From this, it can be concluded that rack tipover would not occur, even without the pit walls. Comparing half the distance between the rack pedestals to the maximum lateral displacement yields a tipover safety factor of approximately 172 on Unit 1 and approximately 180 on Unit 2, both of which far exceed the acceptance criterion of 1.5 (per NUREG-0800). Based on the foregoing, there is no intention to install a support or restraint system to limit rack movement.

Local cell wall integrity was conservatively estimated from peak impact loads As shown in Tables 6.9.1 and 6.9.2 of Enclosure 2, the limiting impact load is much greater than the highest calculated impact load from any rack analysis. Therefore, fuel impacts do not represent a significant concern with respect to rack cell deformation.

The rack structural evaluation determined the resulting stress factors for each rack pedestal, and for the entire rack cellular cross-section just above the bottom casting These locations are the most heavily loaded net sections in the structure, so that satisfaction of the stress factor criteria at these locations ensures that the overall structural criteria are met The maximum pedestal stress factor is 0.197 and the maximum cell wall stress factor is 0.205. An evaluation of the stress factors for all of the simulations performed leads to the conclusion that all stress factors are less than the mandated limit of 1.0.

The largest computed thread stress for each pedestal under SSE conditions was calculated to be 7,446 psi. For conservatism, the actual stress for the SSE condition was compared against the allowable stress for the OBE condition, that is 8,520 psi for the female pedestal threads The allowable stress for the male pedestal threads is much larger due to the higher material strength. Therefore, both the female and male pedestal thread stresses are acceptable.

As discussed in Enclosure 2, Section 6.9.5, weld locations at the bottom of the rack (i.e., the baseplate-to-cell connection, the pedestal-to-baseplate connection, and cell-to-cell connection) are subjected to significant seismic loading. The calculated stress value at each of these weld locations was found to be below the allowable stress value.

As discussed in Enclosure 2, Section 6.12, evaluations were performed on cell-to-cell welded joints and on the possibility of cell wall buckling under the loading conditions arising from thermal effects due to an isolated hot cell. The maximum compressive stress in the cell wall was demonstrated to be significantly below the critical stress calculated using the classical plate buckling method, demonstrating that buckling is not a concern. The maximum shear stress in cell-to-cell joints arising from the thermal effects due to a hot cell demonstrates that the stress is below faulted conditions and is therefore acceptable.

A fatigue analysis for seismic-induced motion was performed on the cask pit racks and is summarized in Enclosure 2, Section 6.9.4. The analysis determined the cumulative damage factor resulting from 20 OBEs followed by 1 SSE. This analysis showed that the factor of safety is greater than 5 for fatigue within the rack components.

Finally, a structural evaluation was made of the platforms designed to support the cask pit racks and maintain the rack top elevation level with the SFP racks. The platforms were designed in accordance with ASME Section III, Subsection NF based on maximum calculated pedestal loadings from the supported storage racks. The evaluation showed that the platform stresses are acceptable for faulted and lifting conditions. Safety factors for bearing, tearout, and gross force and moment are greater than 1.0.

Cask Pit Rack Structural Evaluation During Fuel Assembly Drop Events

The USNRC "OT Position Paper for Review and Acceptance of Spent Fuel Storage and Handling Applications" specifies that spent fuel rack designs must ensure the functional integrity of racks under all credible fuel assembly drop events. An evaluation of the consequences of fuel assembly drops onto the cask pit racks for both units was conducted to demonstrate that the racks continue to safely store nuclear fuel following the drop. Two categories of accidental drop events were considered.

Shallow Drop Scenario

A "shallow drop" of a fuel assembly is assumed to strike the top of the rack and damage the honeycomb structure, but not enter an open cell or land directly on an already-stored assembly. The structural acceptance criterion for this event is that the damage to the rack structure must be limited to the portion of the cell(s) above the top of the active fuel region, which is approximately 36 inches below the top surface of the rack. The assumed free-fall height for this event is 36 inches above the rack, and the assumed weight of the dropped assembly plus its handling tool is 2000 lbs. Figure 7.5.1 in Enclosure 2 shows the maximum deformation of a shallow drop on the cask pit racks.

Based on the design of the rack honeycomb structure, the limiting shallow drop scenario that would cause the maximum cell wall deformation occurs at a cell on the rack periphery, rather than at an internal cell. For this limiting case, the dynamic analysis shows that the top of the impacted peripheral cell undergoes plastic deformation to a maximum depth of 12.5 inches, which is less than the 36-inch distance required to reach the top of active fuel in the cask pit rack. Therefore, the functional integrity of the cask pit rack is not compromised by a shallow drop event.

Deep Drop Scenario

A "deep drop" of a fuel assembly occurs when the dropped assembly enters an empty storage cell and impacts the rack baseplate. A sufficiently large impact force could threaten the structural integrity of the baseplate. Two deep drop locations were evaluated: (1) a drop in a cell located directly above a rack pedestal, and (2) a drop in an interior cell away from a pedestal where the baseplate is more flexible. The structural acceptance criteria for a deep drop event are that the baseplate must remain intact and any deformation of the baseplate from the impact must be acceptable both from a structural and a criticality standpoint In addition, the high impact load from a deep drop onto a rack pedestal must not tear the cask pit liner when the force is transmitted into the structure. Note that the platform upon which the rack pedestals rest is actually a box frame resting on corner shim plates that contact the liner. This geometry distributes the load more than narrow rack pedestals that would concentrate the load transmitted into the cask pit liner.

The analysis shows that a fuel assembly deep drop through an interior cell away from a pedestal causes a maximum local baseplate deformation of 1.96 inches, which is less than the 4.25-inch distance from the baseplate to the rack platform. As discussed earlier in Section 3.2, the slight positive reactivity from baseplate deformation caused by a deep drop is acceptable. A deep drop above a pedestal was found to produce a maximum stress below the yield stress of the cask pit liner material. Finally, the maximum compressive stress applied to the concrete pit floor under this drop scenario is less than the concrete compressive strength. Therefore, the liner plate and concrete slab will remain intact without loss of water from the cask pit on any deep drop.

For Unit 2, the gap between the rack and the cask pit wall is sufficient to accommodate a fuel assembly. However, a deep drop of a fuel assembly between the rack and wall that directly impacts the cask pit liner was not evaluated, because such an event is bounded structurally by a cask drop event (100 ton cask dropped from 62.5 feet as described in UFSAR Section 9.1), bounded radiologically by a fuel handling accident (236 failed rods – one assembly – as described in UFSAR Section 15.7.4), and bounded for criticality by a mispositioned fresh fuel assembly inside the rack (as discussed previously in Section 3.2).

FHB Structural Evaluation (including SFP and cask pit)

A structural evaluation was performed on portions of each unit's FHB affected by the addition of a cask pit rack. The evaluation is described in detail in Section 8.0 of Enclosure 2. The evaluation for each unit is discussed separately because of structural differences between cask pit areas. On both units, the cask pit is located in the northeast corner of the FHB, and shares FHB exterior walls on the north and east sides with the respective SFP. The south and west FHB walls are unaffected by the addition of a cask pit rack, and were not considered for this analysis The floor of each cask pit is approximately four feet below the SFP floor elevation, but both areas are coupled through the thick FHB concrete mat. Refer to Enclosure 2, Figures 8.1.1 and 8.1.2, for a plan view showing the cask pit and SFP locations on the FHB mat for each unit.

The massive structural slab supporting the cask pit was not explicitly modeled and evaluated for the incremental weight of a loaded rack. Structural evaluations submitted for previous reracking projects (Unit 1 License Amendment 91, Unit 2 License Amendment 101) were conservative in applying approximately twice the weight of a fuel assembly in all cells to account for the contingency of loading consolidated fuel. Because St. Lucie has not consolidated fuel and the combined weight of the loaded rack and platform is much less than the weight imposed by consolidated fuel, existing analyses of the structural slab and soils are bounding. Therefore, the base mat remains adequate and was checked for bearing stresses in accordance with the ACI code and for liner stresses due to thermal growth.

Unit 1 FHB Structural Evaluation

The Unit 1 structural evaluation was conducted using a finite element model of portions of the north and east exterior FHB walls resting on the FHB concrete mat, as shown in Figures 8.1.2 and 8.1.3 of Enclosure 2. These wall sections are affected by the addition of a new cask pit rack, and the east wall is also affected by the increased loading from an upgraded (150 ton) cask handling crane under normal, tornado, and seismic conditions. The crane loading affects the east wall because portions of the crane support structure rest on one of the east wall columns. For the Unit 1 analysis, the interior (south and west) cask pit walls were conservatively ignored in the finite element model, because the partial-height interior walls are fully submerged with their hydrostatic loads balanced across the walls, and their narrow (~ 6 inches) thickness does not contribute any significant structural support to the six-foot thick exterior walls.

Loads applied to the structural analysis and structural capacity assessments followed the requirements of the Unit 1 UFSAR and ACI 318-63. The load definitions and combinations are given in Section 8.1.4 of Enclosure 2, and include static, seismic, and tornado-induced loads The cask pit load included the dead weight of a cask pit rack fully loaded with fuel assemblies. Thermal loading resulting from the temperature gradient between the SFP and the exterior air temperature was also considered.

The cask pit floor liner was also evaluated for structural effects caused by the new rack. The liner was evaluated for stress due to lateral loads during a seismic event and strain due to differential thermal load between the liner and the underlying concrete when the pit water temperature is at its design basis maximum of 150°F. In addition, vertical load imposed on the liner and underlying concrete from the corner shim plates of the cask pit platform supporting the fully loaded rack was considered Section 8.1.6 of Enclosure 2 discusses the acceptable results of the liner plate and floor evaluation.

The Unit 1 SFP has been previously evaluated to withstand the stresses of bulk boiling with a steady state water temperature of 217°F.

The Unit 1 structural evaluation concluded that the FHB regions affected by the load of a new cask pit rack and upgraded cask handling crane have adequate safety margins under the required loading combinations. The evaluation also concluded that the local loading on the cask pit liner from a fully loaded cask pit rack, seismic motion, and thermal loading does not compromise liner integrity or exceed concrete bearing strength limits.

Unit 2 FHB Structural Evaluation

The Unit 2 structural evaluation was conducted using a finite element model of the four cask pit walls resting on the FHB concrete mat The model conservatively assumes that the four cask pit walls are structurally isolated from the remainder of the FHB and the SFP, and can therefore be analyzed as an independent structure. A separate model of the east FHB wall above El. 62' was also created to analyze the increased loading from an upgraded (150 ton) cask handling crane under normal, tornado, and seismic conditions. The crane loading affects the east wall because portions of the crane support structure rest on one of the east wall columns.

The Unit 2 cask pit interior walls are 5½-foot thick full-height walls that are tied to the 6-foot thick north and east exterior walls, to form a hollow rectangular box from the cask pit floor concrete elevation (16'-6") to El. 36'-3". Above this elevation, a 3-foot wide fuel transfer slot divides the west pit wall. Unlike the Unit 1 analysis that did not model the relatively thin cask pit interior walls, the thicker Unit 2 interior walls are structurally significant and are modeled as shown in Figure 8.2.4 of Enclosure 2.

Loads applied to the structural analysis and structural capacity assessments followed the requirements of the Unit 2 UFSAR and ACI 318-71. The load definitions and combinations are given in Section 8.2.4 of Enclosure 2, and include static, seismic, and tornado-induced loads The cask pit load included the dead weight of a cask pit rack fully loaded with fuel assemblies. Thermal loading resulting from the temperature gradient between the SFP and the exterior air temperature was also considered.

The cask pit floor liner was also evaluated for structural effects caused by the new rack. The liner was evaluated for stress due to lateral loads during a seismic event and strain due to differential thermal load between the liner and the underlying concrete when the pit water temperature is at its design basis maximum of 150°F. In addition, vertical load imposed on the liner and underlying concrete from the corner shim plates of the cask pit platform supporting the fully loaded rack was considered. Section 8.2.6 of Enclosure 2 discusses the acceptable results of the liner plate and floor evaluation.

The Unit 2 SFP has been previously evaluated to withstand the stresses of bulk boiling.

The Unit 2 structural evaluation concluded that the FHB regions affected by the load of a new cask pit rack and upgraded cask handling crane have adequate safety margins under the required loading combinations. The evaluation also concluded that the local loading on the cask pit liner from a fully loaded cask pit rack, seismic motion, and thermal loading does not compromise liner integrity or exceed concrete bearing strength limits.

3.5 HANDLING OF HEAVY LOADS

NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," defines a heavy load as a load whose weight is greater than the combined weight of a single fuel assembly and its handling tool. Dry weights for the empty cask pit racks are approximately 17 tons (Unit 1) and 15 tons (Unit 2) The platforms to be installed under the racks are also heavy loads (approximately 5 tons). Therefore, installation of each cask pit rack and platform (and their eventual removal from the cask pit) into the unit's flooded cask pit will involve handling heavy loads in the vicinity of the SFP. However, the safe load path for installing and removing a cask pit rack will not place the load directly over the SFP at any time.

The cask pit is located in the northeast corner of the respective unit FHB, adjacent to and flooded to the same level as the SFP. An L-shaped door in the FHB roof is located directly over the cask pit area. The spent fuel cask handling crane, which is outside the north end of the FHB, will be used to lower the platform and rack vertically through the L-shaped door directly into the cask pit. Prior to cask pit rack installation, FPL intends to upgrade both cask handling cranes to a design meeting NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants." As allowed by Section 5.1.2 of NUREG-0612, a single-failure proof crane will eliminate the need to analyze for the consequences of a crane heavy load drop of a rack or platform. In the event the cask handling cranes are not fully compliant with NUREG-0554 at the time of rack installation, the appropriate analyses will be performed to demonstrate that the drop of a rack or platform will satisfy the evaluation criteria of NUREG-0612 Section 5.1.

Each unit's cask handling crane is designed with a main hook whose load capacity is limited by Technical Specifications. The load limit for the Unit 1 crane is 25 tons (Unit 1 TS 3.9.13) and the Unit 2 crane load is limited to 100 tons (Unit 2 TS 3.9.12)[1]. The weights of the empty cask pit racks and platforms are well below the crane TS load limits for both units.

To prevent submerging the crane's main hook during rack installation, a temporary hoist with the appropriate capacity will be attached to the main hook, and a Holtec-

1 Note, however, that FPL has proposed relocating these crane loading specifications to the UFSAR in FPL letter to NRC L-2002-111, Proposed License Amendments Relocation of Spent Fuel Crane Technical Specification Requirements, dated July 18, 2002

designed rack lifting rig will be used. With FPL oversight Holtec personnel will perform the initial rack installation process, and Holtec will train FPL personnel in the installation procedure. The rack lifting rig is similar to rigs used for handling Holtec racks at other plants such as Hope Creek, Millstone 1, Fitzpatrick, and TMI-1. The rig consists of four independent traction rods that lock into four locations in the rack baseplate. Each rod has a safety factor greater than 10. If one of the rods should break, the rack will still be supported by at least two rods, with a safety factor of more than five. This arrangement meets the duality criteria for lifting rigs called for in Section 5.1.6(3) of NUREG-0612.

Other guidelines of NUREG-0612 regarding the safe handling of heavy loads will also be followed, including proper procedures, operator training, supervision by qualified individuals, crane inspection, maintenance, and testing. Section 3.5 in Enclosure 2 details the defense-in-depth approach taken to ensure that the handling of the racks and platforms by the cask handling cranes will comply with the NUREG-0612 guidance.

3.6 HANDLING FUEL ASSEMBLIES IN THE CASK PIT

Fuel assembly movement into the new cask pit racks will take essentially the same path as fuel movement required to load a spent fuel transfer cask. Therefore, no new fuel movement pathways are created by the addition of a cask pit rack. The spent fuel handling crane inside each unit's FHB will be used to handle spent fuel assemblies in the cask pit rack. Because the cask pits were not originally considered for spent fuel storage, some peripheral areas of each cask pit rack may not be accessible to the spent fuel handling crane as it is now configured. FPL will determine whether either unit's spent fuel handling crane requires modifications to access all of the cask pit rack cells, and if needed, may modify the crane under 10 CFR 50.59. The St. Lucie fuel handling procedures will be modified to include the cask pit racks when the racks are installed.

Regarding a fuel handling accident (FHA) occurring in the cask pit area, the FHA analyses in Unit 1 UFSAR Section 15.4 and Unit 2 UFSAR Section 15.7.4 evaluate the radiological consequences of a single fuel assembly drop inside FHB, which includes the cask pit area. As discussed previously in Section 3.2, the criticality analysis has demonstrated that dropping a fuel assembly onto the cask pit rack or into an open rack cell will not cause an unacceptable reactivity excursion. From a rack structural standpoint, Section 3.4 discussed that a fuel assembly drop will not threaten the structural integrity of the stored fuel assemblies or the integrity of the storage rack. Therefore, the dose, criticality, and structural integrity consequences of an FHA occurring in the cask pit area are acceptable.

The probability of a FHA occurring will not be increased by the addition of the cask pit racks. As stated in Section 1.0, the cask pit racks will provide storage of nuclear fuel during refueling outage core offloads and during non-outage fuel shuffles. The frequency of fuel assembly movement should be essentially the same with or without the cask pit racks installed, up to the time when the current pool capacity to accommodate a full core offload expires. By adding the new racks, full core offload capability will be extended by approximately three years, allowing additional fuel storage movement during this period, rather than fuel transfer movement to other storage facilities. However, the overall effect during the three-year period should be approximately the same fuel movement frequency for either the storage scenario or the transfer scenario. Therefore, the probability of an FHA with a cask pit rack installed on either unit is not expected to be increased when compared to the current FHA probability without a cask pit rack installed.

3.7 RADIOLOGICAL CONSIDERATIONS

Fuel Handling Accident

The impact of installing the cask pit racks on the probability and radiological consequences of a fuel handling accident is discussed previously in Section 3.6 above.

Additional Radwaste Generation

No significant increase in solid, liquid, or gaseous radwaste generation is expected to result from the installation, use, or removal of the new cask pit racks. Prior to installing the cask pit racks, equipment temporarily stored in the cask pit will be removed and the pit floor will be cleaned using an underwater vacuum to remove any accumulated silt. These activities are expected to generate a small volume of low-level solid radwaste that will be captured underwater in vacuum filter cartridges and properly disposed of using St. Lucie radwaste handling procedures.

Storing and removing fuel assemblies from the cask pit racks is not expected to generate any additional solid or gaseous radwaste from either unit compared to the current practice of storing fuel assemblies in the SFP. Because each cask pit rack must eventually be removed for cask handling operations, rack contamination and activation will be minimized by a fuel loading process that will preferentially select non-failed fuel for storage in this rack. Furthermore, the Unit 1 cask pit rack will normally be used for temporary storage of fresh, unburned fuel and once-burned fuel, such that rack contamination will be minimized.

When a cask pit rack is removed to allow cask handling operations, the rack will be visually inspected underwater to ensure all fuel assemblies and loose debris are removed, then lifted and rinsed with deionized water over the cask pit, flushing loose contamination into the pit water. While the rack is suspended over the cask pit, the individual rack cells will drain through open holes in the rack baseplate. To catch residual water that might drain during movement, the bottom of the rack will be covered with a liner prior to its removal from the FHB. The rack will then be stored in a suitable radiologically-controlled location protected from the elements and capable of containing any postulated leakage. During storage, the rack will be routinely monitored for any residual leakage. Therefore, no significant radwaste is expected to be generated from the rack removal and storage process.

Tritium (${}_1H^3$) is routinely produced in an operating reactor core through neutron capture by deuterium (${}_1H^2$) present in the reactor coolant. The spent fuel storage provided by the cask pit racks will allow approximately three additional years of reactor operation per unit before full core offload capability is lost. Operating the reactor for the additional three-year period will result in producing tritium in the reactor coolant for that period, compared to no tritium production if the reactor was shutdown during the period. However, the production of tritium during normal reactor operation is acceptable and tritium releases are routinely monitored as a component of normal gaseous radwaste releases from the plant. Therefore, normal plant tritium releases will continue for a longer period with the cask pit racks installed, but the magnitude of those releases will be equivalent to the tritium released without the cask pit rack installed. Therefore, the cask pit racks do not contribute to an increase in the frequency or magnitude of tritium release on an annual basis.

Personnel Radiation Exposure

The potential for increased radiation exposure to personnel resulting from the installation of cask pit racks was evaluated. The following possible sources of increased radiation exposure were considered:

- Cask pit cleanup activities prior to rack installation
- Rack installation activities
- Fuel assembly movements
- Area radiation level changes due to fuel stored in the rack
- Rack removal and cleaning activities

Cask pit cleanup will be performed from the refueling floor elevation while the pit is flooded to the same level as the SFP. The combined exposure for the cleanup work on both units is estimated to be 0.1 person-rem, based on a conservative dose rate of 4 mrem/hr and 32 manhours of work. Material removed from the pit will be moved underwater to another storage location. Silt on the pit floor will be vacuumed using an underwater vacuum unit, and the silt will be retained in filter cartridges stored underwater. Once the pit is cleaned, no significant pit preparation should be necessary to install the racks, because no underwater interferences have been identified in either unit's pit that would require removal or modification. No underwater diving is anticipated to be necessary for cleaning or installing the racks.

The cask pit racks will not be radioactive when initially installed, and personnel exposure during rack installation will be governed by the time spent above the SFP and cask pit area. Based on the results of limited physical surveys of each cask pit, the preparation for rack installation will not require divers. Combined personnel exposure from rack installation in both units is estimated to be less than 0.2 person-rem, based on a conservative dose rate above the pool area of 2.5 mrem/hr and 64 manhours of work.

Use of the cask pit racks will require underwater fuel transits in the vicinity of the northeast corner of the FHB, similar to fuel transit paths that would be used during cask loading. These transit paths will not increase the area dose rate beyond that already experienced at either the north or east walls during placement of fuel adjacent to those walls.

Similarly, the general area dose rate from fuel once it is stored in the cask pit racks is expected to be comparable to the dose rate from fuel stored in the SFP racks adjacent to the north and east pool walls, because the water depth to the rack and the exterior wall thickness surrounding the cask pit are the same as the SFP. The maximum dose rate at the outer surface of the cask pit wall with a fully loaded cask pit rack was calculated to be 2 mrem/hr for Unit 1 and 1.43 mrem/hr for Unit 2. Analyses show that use of a barrier row of fuel or use of reasonable decay times will reduce the actual dose rates to well below 0.5 mrem/hr. Therefore, radiation zoning in accessible areas of the FHB and outside walls will not change due to the new fuel storage.

Based on Holtec experience with rack module removal and decontamination projects, the cask pit rack removal and storage process will not create significant personnel exposure. The removal and decontamination process should not result in more than 0.2 person-rem based on a pool surface dose rate of 2.5 mrem/hr, a rack surface dose rate of 20 mrem/hr and an estimated 80 manhours of work.

Therefore, the total personnel radiation exposure from activities related to the installation, fuel storage, and removal of the cask pit racks is not expected to be significant and will be carefully monitored under the St. Lucie ALARA program.

Radiation zoning in accessible areas is not expected to change as a result of cask pit rack installation or operation.

3.8 OTHER ISSUES

a. Soluble Boron Level in the Cask Pit Rack

The cask pit rack criticality analyses achieve a k_{eff} less than 0.95 for any conceivable fuel loading or misloading scenario on either unit with unborated cooling water. Although borated water is not required for cask pit rack reactivity control, the hydraulic coupling and thermal mixing of the water between the cask pit and the SFP when natural circulation is occurring due to spent fuel assemblies in the cask pit rack will maintain the soluble boron concentration essentially the same in the two areas. Therefore, the boron level of water in the cask pit is expected to be approximately the same as the SFP boron level, which is controlled at or above 1720 ppm by plant Technical Specifications.

b. Administrative Control of the Unit 2 Cask Pit Transfer Slot Bulkhead

The Unit 2 cask pit fuel transfer slot is designed to accept a removable metal bulkhead (gate) that, when installed, would hydraulically isolate the cask pit from the SFP. Installing the bulkhead allows the cask pit to be drained without affecting the SFP level. However, when the cask pit rack is installed with fuel assemblies in the rack, the transfer slot must be maintained open to allow cooling water exchange between the SFP and the cask pit. Therefore, administrative controls will be in place to prohibit installing the gate whenever spent fuel is stored in the cask pit rack.

c. Foreign Material Exclusion (FME) During Rack Installation

It is important that fuel stored in the two unit SFPs is protected during installation of the cask pit racks. To ensure that the stored fuel is protected against foreign materials being dropped into the pool, foreign material exclusion methods will be closely followed in accordance with the existing St. Lucie foreign material exclusion procedure.

d. Unit 1 TS 5.6.1.a.4 Description of Boral Neutron Absorber for Cask Pit Rack

Unit 1 TS Section 5.6.1.a.4 currently contains a description of the Boraflex neutron absorber material installed in the Region 1 and Region 2 SFP storage racks. The Unit 1 cask pit rack will contain Boral panels between adjacent rack cells as the neutron absorbing material. For consistency with the existing TS wording, it is appropriate to add a sentence to Unit 1 TS 5.6.1.a.4 that describes the cask pit racks are designed with Boral neutron absorber panels.

Boral has been used extensively in SFP rerack projects and was licensed for use in the two precedent license amendments recently approved (Waterford and Kewaunee).

4.0 CONCLUSION

The addition of a new spent fuel storage rack to each unit's cask pit area was evaluated and found to be acceptable for criticality, thermal-hydraulic considerations, structural adequacy, handling of heavy loads, fuel handling operations, and radiological considerations. The rack design and installation comply with applicable regulatory guidance and industry standards, and are similar to spent fuel storage racks licensed in other nuclear power plants.

The proposed change to the SFP cooling system design basis is consistent with the regulatory guidance in NRC Standard Review Plan Section 9.1.3 for SFP temperature limits during normal and abnormal core offload conditions. The rack and SFP thermal-hydraulic analyses demonstrate that the proposed SFP cooling system design basis is met, and that no bulk boiling will occur in the new rack or SFP with minimum cooling available.

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Description of amendment requests: The proposed license amendments to Facility Operating Licenses DPR-67 for St. Lucie Unit 1 and NPF-16 for St. Lucie Unit 2 will increase the total spent fuel wet storage capacity for each unit, by adding a storage rack in the cask pit area adjacent to each unit's spent fuel pool (SFP). The Unit 1 rack will increase the unit's storage capacity by 143 fuel assemblies and the Unit 2 rack will increase storage capacity by 225 fuel assemblies. Without the proposed changes, Unit 1 and Unit 2 will be unable to offload a full reactor core to the SFP by 2005 and 2007, respectively. With the proposed changes, the additional spent fuel storage capacity will extend full core offload capability for the units until 2008 and 2012, respectively. Extending full core offload capability dates will provide Florida Power and Light (FPL) additional time to evaluate optional spent fuel storage strategies, including SFP reracking, construction of an on-site dry storage facility, and off-site disposal.

Pursuant to 10 CFR 50.92, a determination may be made that a proposed license amendment involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not: (1) involve a significant increase in the probability or consequences of an accident previously evaluated; (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. Each standard is discussed as follows.

1) Would operation of the facility in accordance with the proposed amendments involve a significant increase in the probability or consequences of an accident previously evaluated?

   No. The proposed changes to increase the spent fuel storage capacity with cask pit racks were evaluated for impact on the following previously evaluated events:

   a. A fuel handling accident (FHA)
   b. A heavy load drop into the cask pit
   c. A loss of SFP cooling
   d. A stored fuel criticality event
   e. A seismic event

   The probability of a fuel handling accident is not significantly increased by the proposed changes, because the same equipment (e.g., the spent fuel handling crane) and procedures will be used to handle fuel assemblies and the frequency of fuel movement will be essentially the same, with or without cask pit racks. The FHA radiological consequences are not significantly increased because the source term of a single fuel assembly will remain unchanged, and the cask pit racks will be installed at the same water depth as the existing SFP racks, with the same iodine decontamination factors assumed in the FHA analysis. The structural consequences of dropping a fuel assembly on a cask pit rack were also found to be no more severe than those in the current FHA analysis.

The probability and consequences of a heavy load drop of the cask pit rack or its platform are bounded by the existing cask drop analyses, because a fuel transfer cask is much heavier than either the empty rack or platform, and cask handling will be a more frequent operation in the future than cask pit rack installation and removal. The cask pit rack will be removed prior to any cask handling operations, such that a cask drop scenario onto a cask pit rack loaded with fuel is not credible. Therefore, the probability and the consequences of a heavy load drop in the cask pit are not significantly increased.

The probability of a loss of SFP cooling is unaffected and its consequences are not significantly increased with cask pit racks installed. With the cask pit rack installed, loss of forced cooling results in a sufficient time-to-boil for the operator to recognize the condition and establish SFP makeup to compensate for water lost due to pool bulk boiling, and thereby maintain a sufficient water blanket over the stored spent fuel.

The probability and consequences of a stored fuel criticality event are not increased by the addition of a cask pit rack. The reactivity analysis for the new racks demonstrates that reactivity remains subcritical (below 0.95) for the worst-case fuel mispositioning event, without credit for soluble boron. The probability of a seismic event is unaffected and its consequences are not significantly increased with cask pit racks installed, because the structural analysis of the new racks demonstrates that the fuel storage function of the rack is unimpaired by loading combinations including seismic motion, and there is no adverse seismic-induced interaction between the rack and adjacent structures.

Based on the above, it is concluded that the proposed amendments do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2) Would operation of the facility in accordance with the proposed amendments create the possibility of a new or different kind of accident from any accident previously evaluated?

No. The proposed changes to add a cask pit rack to each unit do not alter the operating requirements of the plant or of the equipment credited in the mitigation of design basis accidents, nor do the proposed changes affect any of the important parameters required to ensure the safe storage of spent fuel. A new rack material (Boral™) is introduced into the pool under these changes, but based on its operating history in SFPs, there are no mechanisms that create a new or different kind of accident. The potential for dropping the new rack or its platform during installation or removal is bounded by the existing analysis for dropping a spent fuel transfer cask into the cask pit. The same equipment (e.g., the spent fuel handling crane) and procedures will be used to handle fuel assemblies for the new cask pit racks as are used for existing spent fuel storage. The fuel storage configuration in the new racks will be similar to the configuration in the existing SFP storage racks, and a fuel drop or mispositioning event in the new racks does not represent a new or different kind of accident from fuel handling and mispositioning events previously evaluated. Therefore, the proposed amendments will not create the possibility of a new or different kind of accident from any accident previously evaluated.

3) Would operation of the facility in accordance with the proposed amendments involve a significant reduction in a margin of safety?

No. The effect of the proposed changes on current margins of safety were evaluated for spent fuel storage functionality and criticality, spent fuel and SFP cooling, and SFP/cask pit structural integrity. The design of the new racks uses proven technology which preserves the proper safety margins for spent fuel storage to provide a coolable and subcritical geometry under both normal and abnormal/accident conditions. The design complies with current regulatory guidelines and the ANSI standards, including 10 CFR 50 Appendix A GDC 62, NUREG-0800 Section 9.1.2, the OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications, Regulatory Guide 1.13, and ANSI/ANS 8.17. Handling the racks and platforms in accordance with the defense-in-depth approach of NUREG-0612 with temporary lift items designed to ANSI N14.6 preserves the proper margin of safety to preclude a heavy load drop in the cask pit.

The proposed SFP cooling system design basis is consistent with the regulatory guidance in NRC Standard Review Plan Section 9.1.3 for SFP temperature limits during normal and abnormal core offload conditions. The rack and SFP thermal-hydraulic analyses demonstrate that the proposed SFP cooling system design basis is met, and that no bulk boiling will occur in the new rack or SFP with minimum cooling available. A loss of SFP cooling will allow sufficient time for operators to identify the condition and initiate makeup flow or restore cooling to preserve fuel cooling capability.

The new rack criticality analyses demonstrate that the subcriticality safety margin is maintained below 0.95 under all conditions, without credit for soluble boron. The structural analyses for the new racks and adjacent structures show that the rack and surrounding structures are unimpaired by loading combinations during seismic motion, and there is no adverse seismic-induced interaction between the rack and adjacent structures. Based on these evaluations, operating the facility with the proposed amendments does not involve a significant reduction in any margin of safety.

Based on the determination made above, the proposed amendments involve no significant hazards consideration.

Environmental Consideration

Thermal effects on the environment due to adding a cask pit rack to each unit will be negligible. Because the size of planned refueling discharges are unchanged, there will be no impact on the SFP decay heat load for the next few cycles (i.e., until approximately 2005; the current projection for losing full core offload (FCO) capability). Beyond that time, a small additional heat load will be imposed on the SFP cooling system from the oldest spent fuel that is allowed to remain in the SFP longer because of the additional storage capacity provided by the cask pit rack. However, this additional decay heat load will be insignificant when compared to the total heat rejected to the environment by the plant.

The proposed license amendments do change requirements with respect to the use of a facility component located within the restricted area as defined in 10 CFR Part 20. However, the proposed amendments involve no significant increase in the amounts and no significant change in the types of any effluents that may be released offsite, and no significant increase in individual or cumulative occupational radiation exposure. Additionally, the proposed amendments involve no significant hazards consideration and therefore meet the criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and that, pursuant to 10 CFR 51.22(b), an environmental impact statement or environmental assessment need not be prepared in connection with issuance of the amendments.

Conclusion

FPL concludes, based on the considerations discussed above: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner; (2) such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

ST. LUCIE UNIT 1 MARKED-UP TECHNICAL SPECIFICATION PAGES

Page 5-6

, a nominal 10.30 inches center to center distance between fuel assemblies in the Region 1 cask pit storage rack,

DESIGN FEATURES

CRITICALITY (Continued)

spent fuel pool

2. A nominal 10.12 inches center to center distance between fuel assemblies in Region 1 of the storage racks and a nominal 8.86 inches center to center distance between fuel assemblies in Region 2 of the storage racks.

spent fuel pool

3. A boron concentration greater than or equal to 1720 ppm.

4. Neutron absorber (boraflex) installed between spent fuel assemblies in the storage racks in Region 1 and Region 2.

spent fuel pool

Neuton absorber (boral) installed between spent fuel assemblies in the Region 1 cask pit storage rack.

b. Region 1 of the spent fuel storage racks can be used to store fuel which has a U-235 enrichment less than or equal to 4.5 weight percent. Region 2 can be used to store fuel which has achieved sufficient burnup such that storage in Region 1 is not required. The initial enrichment vs. burnup requirements of Figure 5.6-1 shall be met prior to storage of fuel assemblies in Region 2. Freshly discharged fuel assemblies may be moved temporarily into Region 2 for purposes of fuel assembly inspection and/or repair, provided that the configuration is maintained in a checkerboard pattern (i.e., fuel assemblies and empty locations aligned diagonally). Following such inspection/repair activities, all such fuel assemblies shall be removed from Region 2 and the requirements of Figure 5.6-1 shall be met for fuel storage.

c. The new fuel storage racks are designed for dry storage of unirradiated fuel assemblies having a U-235 enrichment less than or equal to 4.5 weight percent, while maintaining a k_{eff} of less than or equal to 0.98 under the most reactive condition.

DRAINAGE

5.6.2 The fuel pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

storage racks are

5.6.3 The spent fuel pool ~~is~~ designed and shall be maintained with a storage capacity limited to no more than 1706 fuel assemblies~~.~~

5.7 SEISMIC CLASSIFICATION

5.7.1 Those structures, systems and components identified as seismic Class I in Section 3.2.1 of the FSAR shall be designed and maintained to the original design provisions contained in Section 3.7 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirement.

, and the cask pit storage rack is designed and shall be maintained with a storage capacity limited to no more than 143 fuel assemblies. The total Unit 1 spent fuel pool and cask pit storage capacity is limited to no more than 1849 fuel assemblies.

ST. LUCIE UNIT 2 MARKED-UP TECHNICAL SPECIFICATION PAGES

Page XXII
Page 5-4
Page 5-4A
Page 5-4G

INDEX

LIST OF FIGURES (continued)

DESIGN FEATURES

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 10,931 ± 275 cubic feet at a nominal T_{avg} of 572°F.

5.5 METEOROLOGICAL TOWER LOCATION

5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.

5.6 FUEL STORAGE

CRITICALITY

are designed and

5.6.1 a. The ~~spent fuel pool and~~ spent fuel storage racks shall be maintained with:

1. A k_{eff} equivalent to less than 1.0 when flooded with unborated water, including a conservative allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

2. A k_{eff} equivalent to less than or equal to 0.95 when flooded with water containing 520 ppm boron, including a conservative allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

spent fuel pool

and a nominal 8.80 inch center-to-center distance between fuel assemblies placed in the cask pit storage rack

3. A nominal 8.96 inch center-to-center distance between fuel assemblies placed in the storage racks.

b. Fuel placed in Region I of the spent fuel storage racks shall be stored in a configuration that will assure compliance with 5.6.1 a.1 and 5.6.1 a.2, above, with the following considerations:

1. Fresh fuel shall have a nominal average U-235 enrichment of less than or equal to 4.5 weight percent.

2. The reactivity effect of CEAs placed in fuel assemblies may be considered.

3. The reactivity equivalencing effects of burnable absorbers may be considered.

4. The reactivity effects of fuel assembly burnup and decay time may be considered as specified in Figures 5.6-1c through 5.6-1e.

c. Fuel placed in Region II of the spent fuel storage racks shall be placed in a configuration that will assure compliance with 5.6.1 a.1 and 5.6.1 a.2, above, with the following considerations:

the   spent fuel pool storage racks

1. Fuel placed in Region II shall meet the burnup and decay time requirements specified in Figure 5.6-1a or 5.6-1b.

2. The reactivity effect of CEAs placed in fuel assemblies may be considered.

3. The reactivity equivalencing effects of burnable absorbers may be considered.

Fuel placed in the Region II cask pit storage rack shall meet the burnup requirements specified in Figure 5.6-1f.

DESIGN FEATURES (continued)

CRITICALITY (continued)

5.6.1 d. The new fuel storage racks are designed for dry storage of unirradiated fuel assemblies having a U-235 enrichment less than or equal to 4.5 weight percent, while maintaining a k_{eff} of less than or equal to 0.98 under the most reactive condition.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

storage racks are

5.6.3 The spent fuel ~~storage~~ pool ~~is~~ designed and shall be maintained with a storage capacity limited to no more than 1360 fuel assemblies.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMITS

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1~~.~~

, and the cask pit storage rack is designed and shall be maintained with a storage capacity limited to no more than 225 fuel assemblies. The total Unit 2 spent fuel pool and cask pit storage capacity is limited to no more than 1585 fuel assemblies.

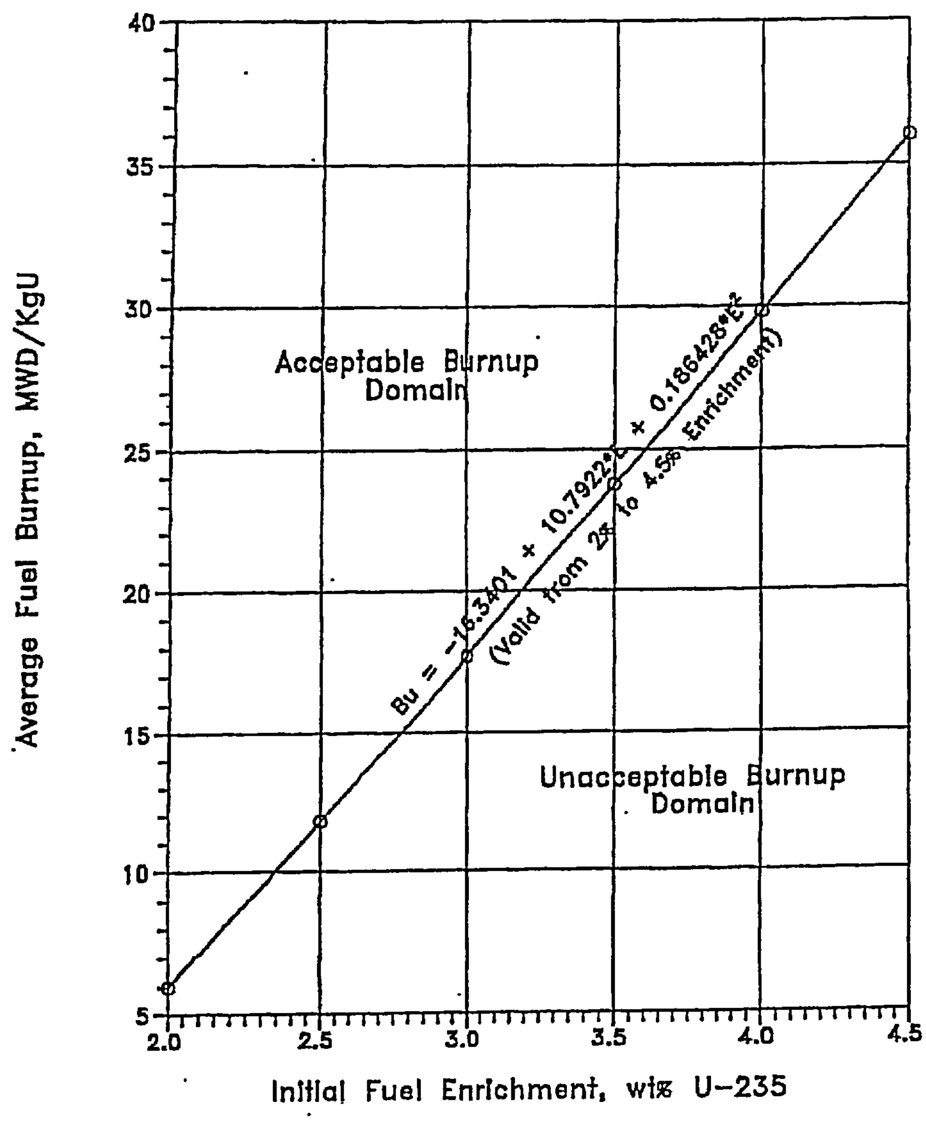

FIGURE 5 6-1f

REQUIRED FUEL ASSEMBLY BURNUP vs INITIAL ENRICHMENT
REGION II CASK PIT STORAGE RACK

ST. LUCIE UNITS 1 AND 2 WORD-PROCESSED TECHNICAL SPECIFICATION PAGES

UNIT 1

Page 5-6

UNIT 2

Page XXII
Page 5-4
Page 5-4A
Page 5-4G

DESIGN FEATURES

CRITICALITY (Continued)

2. A nominal 10.12 inches center to center distance between fuel assemblies in Region 1 of the spent fuel pool storage racks, a nominal 10.30 inches center to center distance between fuel assemblies in the Region 1 cask pit storage rack, and a nominal 8.86 inches center to center distance between fuel assemblies in Region 2 of the spent fuel pool storage racks.

3. A boron concentration greater than or equal to 1720 ppm.

4. Neutron absorber (boraflex) installed between spent fuel assemblies in the spent fuel pool storage racks in Region 1 and Region 2. Neutron absorber (boral) installed between spent fuel assemblies in the Region 1 cask pit storage rack.

b. Region 1 of the spent fuel storage racks can be used to store fuel which has a U-235 enrichment less than or equal to 4.5 weight percent. Region 2 can be used to store fuel which has achieved sufficient burnup such that storage in Region 1 is not required. The initial enrichment vs. burnup requirements of Figure 5.6-1 shall be met prior to storage of fuel assemblies in Region 2. Freshly discharged fuel assemblies may be moved temporarily into Region 2 for purposes of fuel assembly inspection and/or repair, provided that the configuration is maintained in a checkerboard pattern (i.e., fuel assemblies and empty locations aligned diagonally). Following such inspection/repair activities, all such fuel assemblies shall be removed from Region 2 and the requirements of Figure 5.6-1 shall be met for fuel storage.

c. The new fuel storage racks are designed for dry storage of unirradiated fuel assemblies having a U-235 enrichment less than or equal to 4.5 weight percent, while maintaining a k_{eff} of less than or equal to 0.98 under the most reactive condition.

DRAINAGE

5.6.2 The fuel pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

5.6.3 The spent fuel pool storage racks are designed and shall be maintained with a storage capacity limited to no more than 1706 fuel assemblies and the cask pit storage rack is designed and shall be maintained with a storage capacity limited to no more than 143 fuel assemblies. The total Unit 1 spent fuel pool and cask pit storage capacity is limited to no more than 1849 assemblies.

5.7 SEISMIC CLASSIFICATION

5.7.1 Those structures, systems and components identified as seismic Class I in Section 3.2.1 of the FSAR shall be designed and maintained to the original design provisions contained in Section 3.7 of the FSAR with allowance for normal degradation pursuant to the applicable Surveillance Requirement.

INDEX

LIST OF FIGURES (continued)

DESIGN FEATURES

VOLUME

5.4.2 The total water and steam volume of the reactor coolant system is 10,931 ± 275 cubic feet at a nominal T_{avg} of 572°F.

5.5 METEOROLOGICAL TOWER LOCATION

5.5.1 The meteorological tower shall be located as shown on Figure 5.1-1.

5.6 FUEL STORAGE

CRITICALITY

5.6.1 a. The spent fuel storage racks are designed and shall be maintained with:

1. A k_{eff} equivalent to less than 1.0 when flooded with unborated water, including a conservative allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

2. A k_{eff} equivalent to less than or equal to 0.95 when flooded with water containing 520 ppm boron, including a conservative allowance for biases and uncertainties as described in Section 9.1 of the Updated Final Safety Analysis Report.

3. A nominal 8.96 inch center-to-center distance between fuel assemblies placed in the spent fuel pool storage racks and a nominal 8.80 inch center-to-center distance between fuel assemblies placed in the cask pit storage rack.

b. Fuel placed in Region I of the spent fuel storage racks shall be stored in a configuration that will assure compliance with 5.6.1 a.1 and 5.6.1 a 2, above, with the following considerations:

1. Fresh fuel shall have a nominal average U-235 enrichment of less than or equal to 4.5 weight percent.

2. The reactivity effect of CEAs placed in fuel assemblies may be considered.

3. The reactivity equivalencing effects of burnable absorbers may be considered.

4. The reactivity effects of fuel assembly burnup and decay time may be considered as specified in Figures 5.6-1c through 5.6-1e.

c. Fuel placed in Region II of the spent fuel storage racks shall be placed in a configuration that will assure compliance with 5.6.1 a.1 and 5.6.1 a.2, above, with the following considerations:

1. Fuel placed in the Region II spent fuel pool storage racks shall meet the burnup and decay time requirements specified in Figure 5.6-1a or 5.6-1b. Fuel placed in the Region II cask pit storage rack shall meet the burnup requirements specified in Figure 5.6-1f.

2. The reactivity effect of CEAs placed in fuel assemblies may be considered.

3. The reactivity equivalencing effects of burnable absorbers may be considered.

DESIGN FEATURES (continued)

CRITICALITY (continued)

5.6.1 d. The new fuel storage racks are designed for dry storage of unirradiated fuel assemblies having a U-235 enrichment less than or equal to 4.5 weight percent, while maintaining a k_{eff} of less than or equal to 0.98 under the most reactive condition.

DRAINAGE

5.6.2 The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 56 feet.

CAPACITY

5.6.3 The spent fuel pool storage racks are designed and shall be maintained with a storage capacity limited to no more than 1360 fuel assemblies and the cask pit storage rack is designed and shall be maintained with a storage capacity limited to no more than 225 fuel assemblies. The total Unit 2 spent fuel pool and cask pit storage capacity is limited to no more than 1585 fuel assemblies.

5.7 COMPONENT CYCLIC OR TRANSIENT LIMITS

5.7.1 The components identified in Table 5.7-1 are designed and shall be maintained within the cyclic or transient limits of Table 5.7-1.

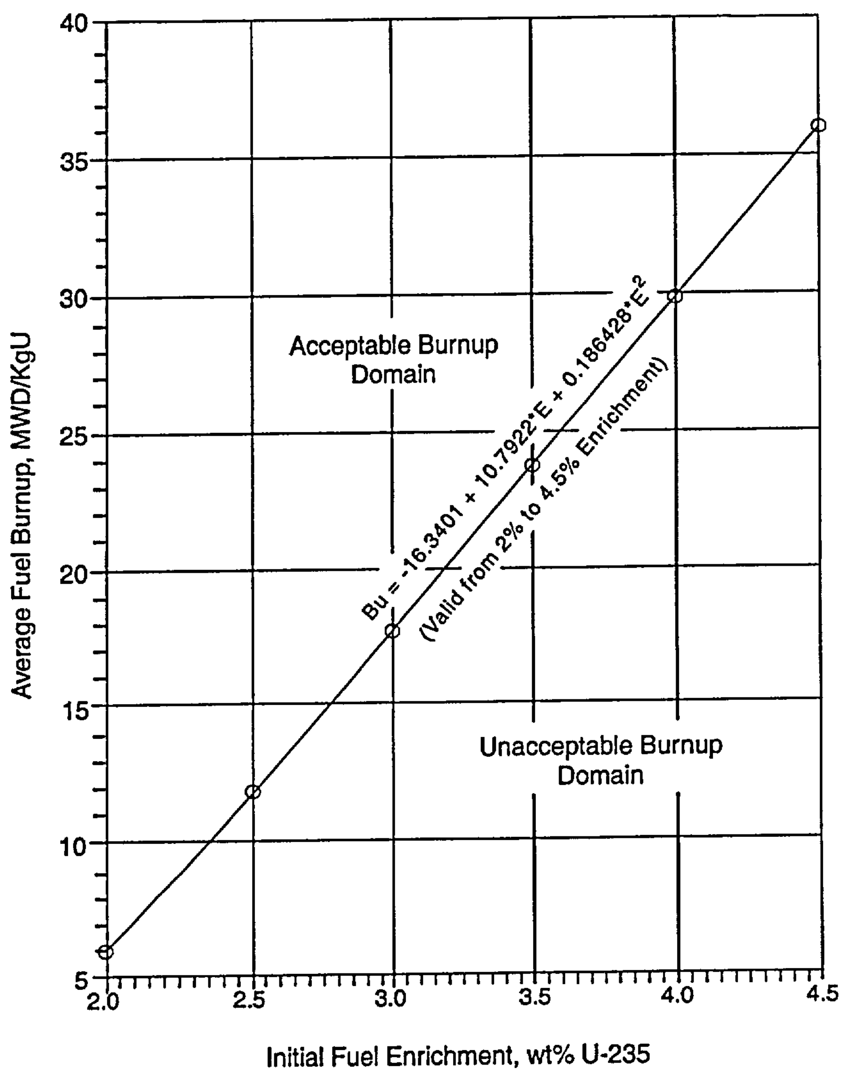

FIGURE 5.6-1f

REQUIRED FUEL ASSEMBLY BURNUP vs INITIAL ENRICHMENT
REGION II CASK PIT STORAGE RACK

L-2002-187
Enclosure 1

AFFIDAVIT PURSUANT TO 10 CFR 2.790

5 total pages including this
cover page

AFFIDAVIT PURSUANT TO 10CFR2.790

I, Scott H. Pellet, being duly sworn, depose and state as follows:

(1) I am the Project Manager for Holtec International and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in the document entitled "Spent Fuel Storage Expansion at St. Lucie Units 1 and 2," Holtec Report HI-2022882, revision 1. The proprietary material in this document is delineated by proprietary designation (i.e., shaded text) on pages 3-15, 4-4, 4-6, 4-7, 4-8, 4-28, 4-34, 4-36, 5-6, 5-7, 6-23, 6-24, 6-29, 7-3, and 7-4.

(3) In making this application for withholding of proprietary information of which it is the owner, Holtec International relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10CFR Part 9.17(a)(4), 2.790(a)(4), and 2.790(b)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, <u>Critical Mass Energy Project v. Nuclear Regulatory Commission</u>, 975F2d871 (DC Cir. 1992), and <u>Public Citizen Health Research Group v. FDA</u>, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by Holtec's competitors without license from Holtec International constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

c. Information which reveals cost or price information, production, capacities, budget levels, or commercial strategies of Holtec International, its customers, or its suppliers;

d. Information which reveals aspects of past, present, or future Holtec International customer-funded development plans and programs of potential commercial value to Holtec International;

e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 4.a, 4.b, 4.d, and 4.e, above.

(5) The information sought to be withheld is being submitted to the NRC in confidence. The information (including that compiled from many sources) is of a sort customarily held in confidence by Holtec International, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by Holtec International. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within Holtec International is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his designee), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures

outside Holtec International are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information classified as proprietary was developed and compiled by Holtec International at a significant cost to Holtec International. This information is classified as proprietary because it contains detailed historical data and analytical results not available elsewhere. This information would provide other parties, including competitors, with information from Holtec International's technical database and the results of evaluations performed using codes developed by Holtec International. Release of this information would improve a competitor's position without the competitor having to expend similar resources for the development of the database. A substantial effort has been expended by Holtec International to develop this information.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to Holtec International's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of Holtec International's comprehensive spent fuel storage technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology, and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by Holtec International.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

Holtec International's competitive advantage will be lost if its competitors are able to use the results of the Holtec International experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to Holtec International would be lost if the

AFFIDAVIT PURSUANT TO 10CFR2.790

information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive Holtec International of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

STATE OF NEW JERSEY)

) ss:

COUNTY OF BURLINGTON)

Scott H. Pellet, being duly sworn, deposes and says:

That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at Marlton, New Jersey, this 4th day of September, 2002.

Scott H. Pellet

Mr. Scott H. Pellet
Holtec International

Subscribed and sworn before me this 4th day of September, 2002.

Maria C. Pepe

MARIA C. PEPE
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 25, 2005